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Federal-State Cooperative

Snow Surveys and Water Supply Forecasts

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## **ARIZONA**

SOIL CONSERVATION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

Data included in this report were obtained by the agency named above in cooperation with the Federal, State and local organizations listed on the last page of this report.

AS OF

### UNITED STATES DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

TO RECIPIENTS OF COOPERATIVE SNOW SURVEY AND WATER SUPPLY FORECAST REPORTS:

Forecasts by U. S. Weather Bureau of total annual streamflow October-September, inclusive, at more than 300 gaging stations are issued monthly January through May in the publication WATER SUPPLY FORECASTS FOR THE WESTERN UNITED STATES.

Weather Bureau forecasts of runoff presented in that bulletin are computed from procedures based on mathematical analysis of the relation between precipitation and runoff.

The Weather Bureau bulletins may be secured by writing to:

Hydrologist in Charge River Forecast Center U. S. Weather Bureau 712 Federal Office Building Kansas City 6, Missouri

For current information on local river and flood conditions, reference should be made to the appropriate River District Office, listed below:

Meteorologist in Charge...............Colorado River and
Weather Bureau Airport Station tributaries in Arizona
3000 Sky Harbor Blvd., except San Juan
Phoenix, Arizona

State of Arizona

#### COOPERATIVE SNOW SURVEYS and WATER SUPPLY FORECASTS

for

#### ARIZONA

(Salt, Verde, Gila part of Lower Colorado River Basin)

Issued

March 1, 1955

Report Prepared

By W. E. Anderson, Snow Survey Leader

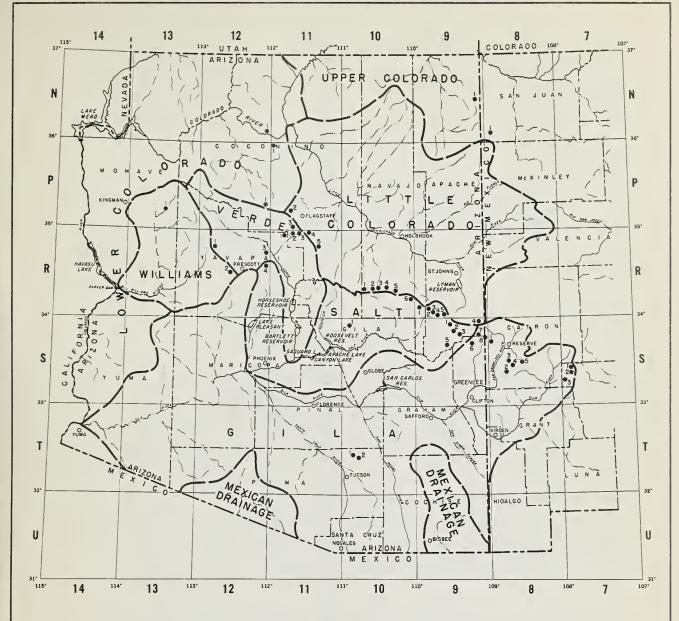
Salt River Valley Water User's Association and Soil Conservation Service Main Post Office Bldg. Phoenix, Arizona

Issued By

Robert V. Boyle State Conservationist

Victor I. Corbell President Soil Conservation Service Salt River Valley Water Users' Ass'n.

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# LEGEND DRAINAGE BASIN BOUNDARY SNOW COURSE

# ARIZONA COOPERATIVE SNOW SURVEYS

SNOW COURSES AND DRAINAGE BASINS
JANUARY 1955



NUMBER	NAME	SEC	TWP	RGE** E	LEVATION	RIVER BASIN
11-P-3	Antelope Park	29	19N	8E	7300	Verde Discontinued
9-S-1	Baldy	28	7N	27E	9000	Salt-Little Colorado
10-T-1	Bear Wallow	6	125	16E	8100	Gila
9-S-6	Beaver Head	13	4N	30E	8000	Salt-Frisco
9-S-3	Big Lake Knoll	2	5N	28E	8800	Salt-Frisco-Little Colorado Discontinued
7-S-3	Black Canyon	8	135	11W***	6790	Gila
12-N-1	Bright Angel	34	33N	3E	8400	Lower Colorado
12-R-1	Camp Wood	3	16N	6W	5700	Williams-Verde
10-R-3	Canyon Creek (s)	18	11N	15E	7500	Salt
11-R-2	Casner Park (s)	19	18N	8E	6950	Verde
12-P-1	Chalender (s)	27	22N	3E	7100	Verde
8-5-3	Corner Mountain	7	105	17W***	8850	Gila-Frisco
9-5-7	Coronado Trail	26	5N	30E	8000	Salt-Frisco
10-R-2	Elk	31	11N	14E	7600	Salt-Little Colorado Discontinued
10-R-6	Forest Dale (s)	2	9N	21E	6000	Salt-Little Colorado
10 10	Total Bale (3)	-	713	216	0000	Sail Ellife Colorado
12-R-4	Gaddes Canyon	11	15N	2E	7600	Verde #
10-R-5	Gentry	36	11N	15E	7600	Salt-Little Colorado
11-P-2	Fort Valley	22	22N	6E	7350	Verde #
9-R-5	Ft. Apache	18	7N	27E	9160	Salt-Little Colorado
8-5-1	Frisco Divide	31	6S	20W***	8000	Frisco-Gila
11-P-1	Grand Canyon	21	30 N	4E	7500	Lower Colorado
11-R-5	Happy Jack	30	17N	9E	7630	Verde
10-R-4	Heber	28	11N	15E	7600	Salt-Little Colorado
7 <b>-</b> S-2	Inman	6	115	10W***	7800	Gila
12-R-2	Iron Springs	22	14N	3W	6200	Williams-Verde
9-S <b>-</b> 2	Maverick Fork (s)	13	6N	27E	9050	Salt-Little Colorado
9-R-4	McKay Peak	13	7N	24E	8250	Salt Not read
9-R-2	McNary (s)	14	8N	23E	7200	Salt-Little Colorado
9-R-1	Milk Ranch	28	8N	23E	7000	Salt
12-R-3	Mingus Mountain	3	15N	2E	7100	Verde #
12-11-5	Miligos Modifiani	3	1314	ZL	7100	Velue
8-5-2	Mogollon	2	115	19W***	7000	Frisco-Gila
11-R-4	Mormon Lake	13	18N	8E	7350	Verde #
11-R-3	Mormon Mountain(s)		18N	8E	7500	Verde
11-R-1	Munds Park (s)	7	18N	7E	6500	Verde
8 <b>-</b> S-4	N-Bar Lake	16	10\$	17W***	8600	Gila
8-S-5	Negrito	6	10S	16W***	8200	Gila
9-S-4	Nutrioso	23	6N	30E	8500	Salt-Frisco-Little Colorado
9-5-5	Pacheta	At toy	vn of May	verick <mark>, Ariz</mark>	. 7800	Salt
9-N-1	Roof Butte	15	8N	6W****	8500	Little Colorado # Not read
10-T-2	Rose Canyon	15	125	16E	7300	Gila
9 <b>-</b> S-8	State Line	6	6S	21W***	8000	Gila-Frisco
7-S-1	Taylor Creek	20	105	10W***	7850	Gila
9-R-3	Trout Creek	5	7N	24E	6400	Salt Not read
8-N-1	Washington Pass Lat					Little Colorado # Not read
13-P-1	Willow Ranch	16	21 N	11W	5000	Williams
10-1-1	THIOW RUICII	10	2114	1144	5000	THI TOTAL
10-R-1	Woods Canyon		11N	13E	7640	Salt-Little Colorado Discontinued
10 <b>-</b> S-1	Workman Creek	33	6N	14E	6900	Salt

Number indicates location of course within coordinate rectangle, thus 9-N-1 is Course #1 in coordinate rectangle 9-N.

All in Gila and Salt River Base and Meridian except where otherwise indicated.

New Mexico Principal Meridian.

<sup>\*\*</sup> Navajo Base.
On adjacent drainage.

<sup>(</sup>s) Soil Moisture Station installed on or in vicinity of course.

<sup>§</sup> Unsurveyed.

#### WATER SUPPLY OUTLOOK

#### ARIZONA

#### March 1, 1955

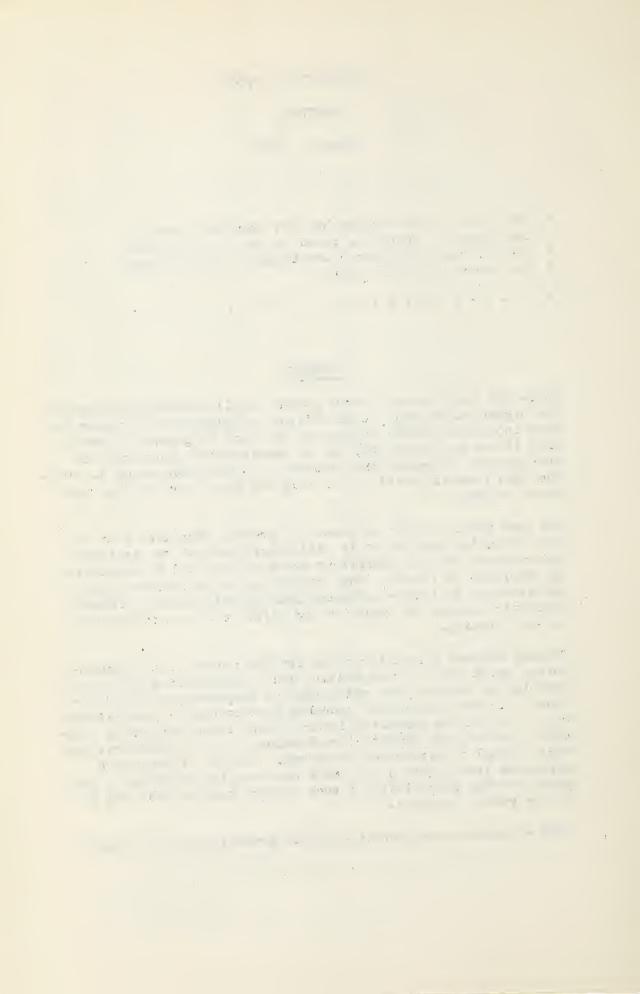
#### GENERAL

There are large areas of bare ground on all watersheds except at the higher elevations. Soil moisture conditions remain poor in most locations. Water content of the snow is generally greater than it was two weeks ago, due to precipitation occurring in that period. However, this increase has not been enough to overcome the general deficiency in rain and snow over the fall and winter months.

The snow water content is generally greater than last year at this time, but the dry soils will absorb much of the available water unless weather conditions occur which would be particularly favorable to runoff. Such conditions would include higher temperatures to induce increased melting and possibly precipitation to augment the supplies and offset the loss of moisture to soil priming.

Present Weather Bureau forecasts are for below normal temperatures, which would retard melting and if accompanied by dry air, promote the loss of snow water through evaporation or sublimation. It does not appear probable that extensive precipitation will occur in the immediate future. Long range prognostic forecasts indicate the probability of below normal temperatures and above normal precipitation for March. Storms of important magnitude late in the season have occurred infrequently in the past, and the probability of such a storm becomes less and less as the season advances.

High elevation snow courses continue generally below average in



water content, while those at low and intermediate elevations have water content at or slightly above average for this time of year. This is the reverse of the usual relationship and reflects the storm patterns of this winter. Observers report considerable granular snow on the courses, which is an indication of the extent to which the pack has ripened.

Some streams are beginning to flow, but most are clear. The only report of muddy water comes from the vicinity of Alpine in the Frisco drainage. No running streams have been observed in the Verde-Flagstaff area.

Reservoir storage in the state is 105% of the 10-year average at this time, but significantly is only 26% of capacity.

#### SNOW COVER AND WATERSHED CONDITIONS

#### Verde River Basin

Recent light storms have added to the water content of the snow courses on this drainage. Courses are generally above average, but the snow cover at lower elevations is rapidly decreasing. Soil moisture conditions have improved slightly, but remain abnormally dry over large areas. Deficient fall precipitation contributed to the low soil moisture content, particularly if the weather remains cool and melting occurs slowly.

Stream flow generally continues far below normal. Reservoir storage in Bartlett and Horseshoe dams is 67,000 acre feet, 108% of normal for this date. The prospect appears very remote for substantial gains in these reservoirs which furnish water supplies for the city of Phoenix and the Salt River Valley Water Ussers' Association.

Lake Mary is extremely low, with little likelihood at this time for any important gains in storage from snow melt. Mormon Lake, also very low, has somewhat more moisture in the watershed snow cover, but the quantities available at this time are not sufficient to make much difference in lake levels.

#### Salt and Tonto River Basin

The snow cover is generally better than in recent years but on this watershed also the severe deficiency in soil moist-

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ure, resulting from below-normal fall preciptation, will limit the amount of runoff that can occur.

Some gains in snow course moisture content have occurred; however, total available moisture is still insufficient to provide for more than minimum runoff. Weather conditions will affect the final runoff quantities materially, but unless there is a considerable improvement it would be unrealistic to anticipate any runoff in excess of the forecasts previously made.

Stream flows in both the Salt and Tonto continue much below normal. U.S. Gelogical Survey reports indicate that the total discharge in February was the lowest on record for this month, amounting to only 29% of normal. The Salt River Reservoirs have 122% of the 10-year average in storage. This carryover of more than 800,000 acre feet should, with careful management, provide for adequate water supplies for the Salt River Valley for this year. However, there remains the possibility of practically empty reservoirs by fall if present weather conditions hold.

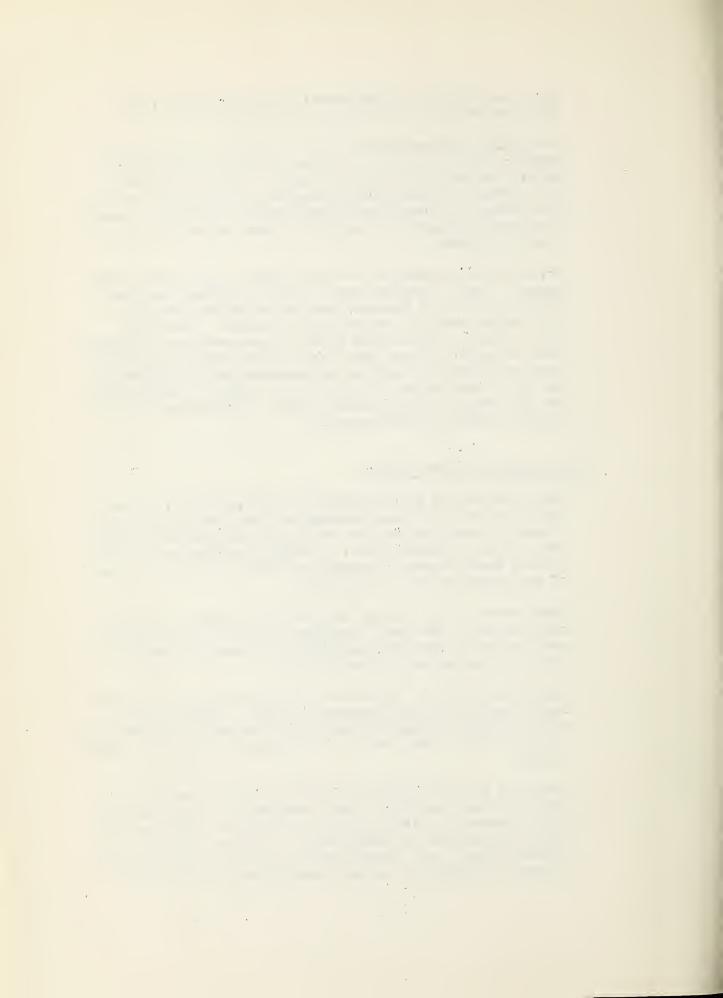
#### Gila and Frisco River Basins

Large portions of the Gila Basin are bare, and all courses report below normal water contents. There are considerable volumes of snow remaining at the higher elevations, particularly in the wilderness area. However, on this river basin also it would require favorable conditions to bring out much of the remaining water as run-off.

Snow courses on the Frisco are some what better, but still below normal. The lower elevations are all bare, however, and the total amount of runoff from snow melt can only be very small under present conditions.

Recent snow melt on the Gila and Frisco has resulted in some improvement of the soil moisture content. However, it is only in limited areas that the soil is saturated and over most of the basin the early season deficiency has only been partly offset.

The Santa Catalina Mountains continue above normal in snow cover. Water supplies in this range should be good for the coming season, and it is possible that flows in Sabino Creek may be better than in recent years. However, the area involved is small, and these mountains do not normally contribute much directly to surface water supplies of the Gila



River proper. They lie downstream from the principal storage reservoir.

Gila River discharge during February was among the lowest ever recorded on this stream. Storage in San Carlos reservoir amounts to 35,000 acre feet, 25% of the 10-year average for this time, and only a small fraction of capacity. It does not appear probable that substantial increase in the storage volume will occur.

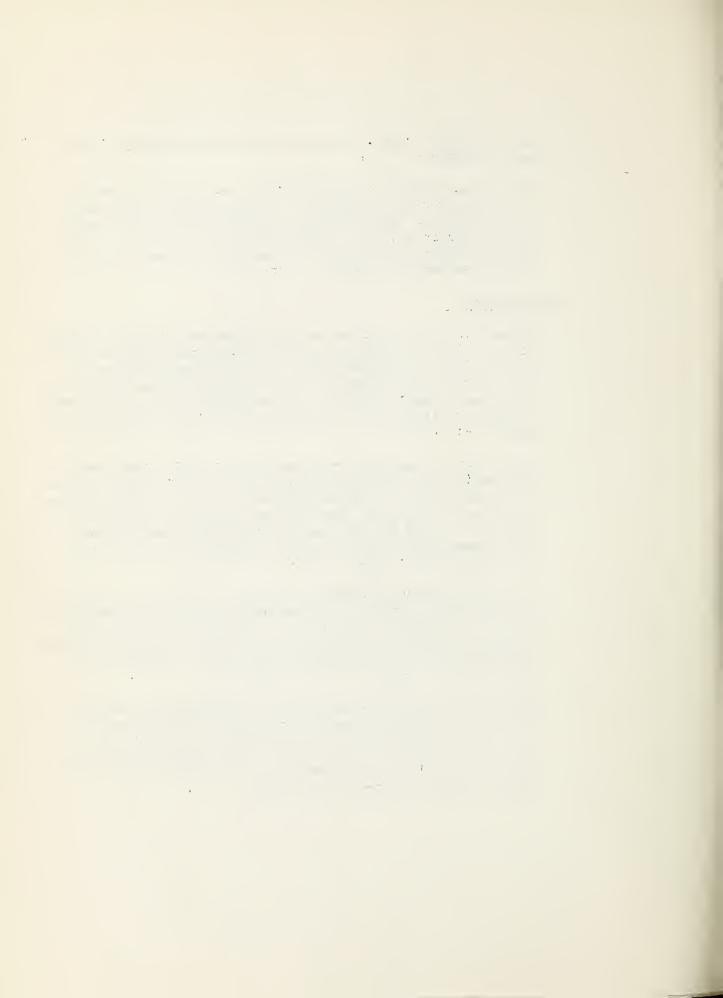
#### Other Basins

There is no snow reported on any courses on the Bill Williams River. Early snow has all melted and the resulting increase in soil moisture content should help to improve the range cover conditions somewhat. It is doubtful if the amount of water was enough, however, to more than partially offset the drought conditions that have covered this and adjacent drainages.

Snow cover on the north rim, previously below normal, has improved and is now only slightly below normal. Grand Canyon on the south rim, is above average as is most of the contiguous area. Flow in the lower Colorado River is at the lowest stages on record for this month. Storage in the Colorado River reservoirs is approximately 4,000,000 acre feet below last year at this time?

The Little Colorado drainage is generally much below average in snow water content. Snow has melted up to about the lower edge of the timber. Considerable snow still remains at the higher elevations, but present conditions do not indicate any probability that Lyman reservoir will fill. Storage is now 1900 acre feet, 27% of normal at this time.

Snow has melted completely on the drainage area of the Auga Fria River, with the exception of a few protected locations. There is no expectation of runoff from snow melt on this drainage. Reservoir storage in Lake Pleasant is 23,000 acre feet, 122% of the 10-year average but only 13% of capacity and 9,000 acre feet below last year.

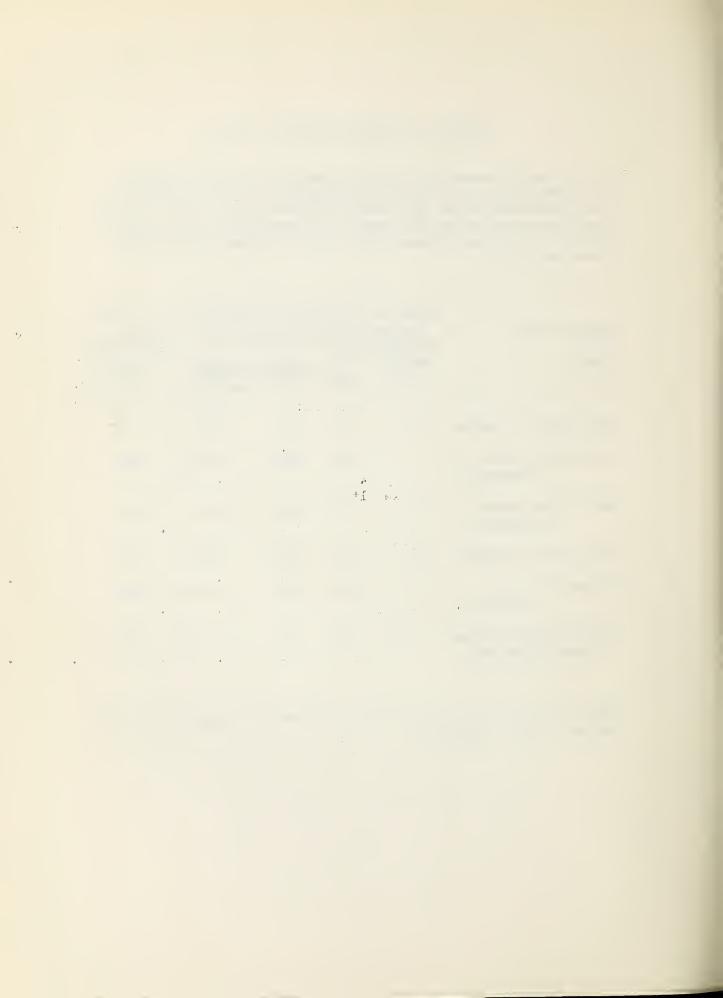


#### STREAM FLOW FORECASTS MARCH 1, 1955

The following summarized runoff forecasts are based principally on mountain snow cover and on the assumption that precipitation and temperature during the forecast period will be near average. Appreciable deviations from normal of temperature and/or precipitation during the forecast period will correspondingly modify these forecasts.

Basin, Stream			flow in Th		of Acre Ft.
and	Forecast	%			10 - Yr.
Station	Runoff	10-Yr.	Measured	Runoff	Average
	1955	Ave.	1954	1953	1943-52
Salt River at intake	55.	23.	214.	128.	240.8
Tonto River above Roosevelt	7.	23.	29.5	25.1	30•4
Verde River above Horseshoe	48.	31.	163.	40.	153.8
Gila River at Virden	13.	37.	20.6	22.2	35.0
Frisco River at Clifton	9.	29.	27.9	14.2	31.2
Little Colorado River above Lyman Dam	1.1	14.	1.7	1.5	7.7*

<sup>\*</sup>Forecast period for Little Colorado River above Lyman Dam is for March - June, inclusive.



SUMMARY OF MARCH 1, 1955 SNOW SURVEYS AND COMPARISON OF DATA WITH THAT OF PREVIOUS YEARS BY WATERSHEDS

C was a pay Cine III was a	No. of Courses	Snow	Snow	Water Co	ntent	Snow Water Content in Inches	Snow Density	1955 Wat in per	1955 Water Content in percent of
WATEKSHEDS	in Average	1956 Inches	1955	1954	1953		1955 %	1954	Average
Gila River	රා	4.4	1.2	0.1	1.6	1.7	26.3	1200	68
Salt River	14	10.6	3.2	1.4	3.0	6 8	29.8	237	109
Verde River	10	11.9	4°0	0.8	1.3	2.7	33.6	2500	148
Williams River	ъ	0°0	0.0	0.0	0.2	1.0	ı	t	ı
Lower Colorado River	4	21.3	5.5	1.6	3.1	403	26.0	345	130
Little Colorado River	10	11.5	4.1	0.4	1.8	9°2	35.4	1041	154

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					SNOW COV	ER MEAS			
DRAINAGE BASIN				1955			PAST	RECORD	
and			Date	Snow	Water				Years
SNOW COURSE			of	Depth	Content			nt (in.)	of
	No.	Eleva	Survey	(in.)	(in.)	1954	1953	Average	Record
GILA RIVER									
Nutrioso	9-5-4	8500	2/28	6.0	1.6	0.1	0.6	2.0	17
Bear Wallow*	10-T-1	8100	2/28	15.0	5.4	1.5	3.7	2.4	7
Frisco Divide	8-8-1	8000	2/28	7.0	1.7	0.2	2.2	1.9	17
State Line	9-5-8	8000	2/28	9.0	2.4	0.3	2.0	2.6	17
Coronado Trail	9-8-7	8000	2/28	10.0	3.1	0.0	1.7	3.2	17
Beaver Head	9-8-6	8000	2/28	8.0	1.7	0.0	2.6	3.2	17
Taylor Creek	7-5-1	7850	3/1	0.0	0.0	-	1.4	0.6	13
Inman	7-S-2	7800	3/1	0.0	0.0	T	1.3	0.7	9
Rose Canyon*	10-T-2	7300	2/28	2.0	0.9	0.0	2.5	0.7	7
Mogollon	8-5-2	7000	3/1	0.0	0.0	0.0	1.8	0.9	2
Black Canyon	7-S-3	6790	3/1	0.0	0.0	0.0	0.5	0.3	2
SALT RIVER									
Ft. Apache**	9-R-5	9160	3/2	20.5	4.8	5.4	5.9	6.3	5
Baldy**	9-8-1	9125	3/2	19.2	4.8	5.2	6.3	6.5	5
Maverick Fork	9-8-2	9030	3/2	26.4	7.0	4.1	4.4	7.6	4
Nutrioso	9-S-4	8500	2/28	6.0	1.6	0.1	0.6	2.0	17
Coronado Trail		8000	2/28	10.0	3.1	0.0	1.7	3.2	17
Beaver Head	9-\$-6	8000	2/28	8.0	1.7	0.0	2.6	3.2	17
Pacheta	9-5-5	7800	3/1	11.0	3.1	0.0	6.0	2.3	5
Gentry	10-R-5	7600	3/1	8.1	3.1	T	-	0.7	5
Heber	10-R-4	7600	3/1	8.3	3.2	Ť	6.0	2.2	4
Canyon Creek	10-R-3	7500	3/1	11.6	4.5	Ť	-	1.1	4
McNary	9-R-2	7200	3/1	6.1	2.5	3.8	0.4	2.8	16
Milk Ranch	9-R-1	7000	3/1	3.0	0,9	0.0	0.2	0.8	13
Workman Creek	10-5-1	6900	2/28	8,0	3.1	0.0	2.2	0.7	3
Forest Dele	10-R-6	6430	3/1	1.7	0.7	0.0	0.0	1.1	16
VERDE RIVER									
	מ. מ. וו	7670	2/1	77 0	6 7		7 4	4.0	4
Happy Jack	11-R-5	7630	3/1	17.0	6.3	— m	1.4	4.2	4
Gaddes Canyon* Mormon Mountain		7600 7500	3/2	17.0	5.1	T	- 2 0	4 0	1
Mormon Lake**	11-R-4	7350	2/28	24.0	7.8	T	2.9	4.2	5
			3/1	20.0	6,9	T	2.1	5.5	8
Fort Valley** Mingus Mountian	11-P-2	7350	2/28	14.8	4.0	T	0.9	2.5	8
Chalender	12-R≈3 12-P∞1	7100	3/2	0.0	0.0	0.0	1.0	1.6	8
Casner Park		7100	3/1	16.0	4.9	1.6	2.0	3.2	8
Munds Park	11-R-2 11-R-1	6930 6500	2/28	18.0	5.9	0.0	1.1	2.5	5 5
Iron Springs**		6200	2/28	12.0	4,2	0.0	0.8	0.8	9
Camp Wood			2/28	0.0	0.0	0.0	0.0	1.6	9
oamp wood	12 <b>-</b> R-1	5700	3/1	0.0	0.0	0.0	0.7	1.0	9

<sup>\*</sup> Not included in averages \*\* On adjacent drainage



### ARIZONA SNOW SURVEY MARCH 1, 1955

					SNOW COV	ER MEAS	SUREME	NTS	
DRAINAGE BASIN	•			1955			PAST	RECORD	
and SNOW COURSE	No.	Elev.	Date of Survey	Snow Depth (in.)	Water Content (in.)	Water 1954	Conte	ent (in.) Average	Years of Record
WILLIAMS RIVER									*
Iron Springs	12-R-2	6200	2/28	0.0	0.0	0.0	0.0	1.6	9
Camp Wood	12-R-1	5700	3/1	0.0	0.0	0.0	0.7	1.0	9
Willow Ranch	13-P-1	5000	3/1	0.0	0.0		0.0	0.3	9
LOWER COLORADO	RIVER								
Bright Angel	12-N-1	8400	3/1	29.0	8.8	4.8	5.0	9.2	8
Grand Canyon	11-P-1	7500	3/1	18.0	4.4	T	4.5	2.1	8
Fort Valley	11-P-2	7350	2/28	14.8	4.0	T	0.9	2.5	8
Chalender**	12-P-1	7100	3/1	16.0	4.9	1.6	2.0	3.2	8
LITTLE COLORAD	O RIVER								
Nutrioso	9-3-4	8500	2/28	6.0	1.6	0.1	0.6	2.0	17
Happy Jack	11-R-5	7630	3/1	17.0	6.3		1.4	4.2	4
Gentry	10-R-5	7600	3/1	8.1	3.1	${f T}$	-	0.7	5
Heber	10-R-4	7600	3/1	8.3	3.2	T	6.0	2.2	4
Canyon Creek	10-R-3	7500	3/1	11.6	4.5	T	-	101	4
Mormon Mountain	11-R-3	7500	2/28	24.0	7.8	T	2.9	4.2	5
Mormon Lake	11-R-4	7350	3/1	20.0	6.9	T	2.1	5.5	8
Fort Valley	11-P-2	7350	3/1	14.8	4.0	T	0.9	2.5	8
MoNary	9-R-2	7200	3/1	6.1	2.5	3.8	0.4	2。8	16
Forest Dale	10-R-6	6430	3/1	1.7	0.7	0.0	0.0	1.1	16

<sup>\*\*</sup> On adjacent drainage

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STATUS OF RESERVOIR STORAGE MARCH 1, 1955

BASIN	C	THO	USAND A ABOUT	IN STORAGE 1955			
and STREAM		APACITY housand re Feet)	1955	1954	1953	1952	10 Year Average 1943-52
Agua Fria	Lake Pleasan	t 178	23	33	82	124	18.9
Colorado	Lake Havasu	668	616	620	608	598	605
Colorado	Lake Mohave	1,810	1,710	1,691	1,591	1,612	•••
Colorado	Lake Mead	27,237	11,869	16,242	18,312	16,540	18,466
Gila	San Carlos	1,285	35	0	8	155	140
Verde	Bartlett	180	65	40	38	153	43
Verde	Horseshoe	143	1.	8 11	1	55	18.8
Salt	Roosevelt	1,382	464	572	1,014	496	404
Salt	Apache	245	240	243	221	202	199
Salt	Canyon	58	54	5 <b>7</b>	5 <b>7</b>	40	35
Salt	Saguaro	70	5 <b>5</b>	57	57	46	28
Little Colo.	Lyman	28	1.	9 _	9.2	2 1.	1 7

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#### LIST OF SNOW SURVEYORS

SNOW COURSE	SURVEYOR
Baldy	SCS and SRVWU
Bear Wallow	Wm. Hughes & J.R. Brinkley
Beaver Head	Jess Burke
Black Canyon	Robert M. White
Bright Angel	Velentine & Busa
Camp Wood	Wre. C. C. Merritt
Canyon Creek	SCS and SRVWII
Casner Park	SCS and SPIMII
Chalender	M C Ologon and F. G. Doughert
Corner Mountain	
Coronado Trail	
Forest Dale	Olean
Frisco Divide	Vison
Ft. Apache	CCC and CDUMII
Fort Valley	
Gaddes Canyon	Richard Enz
Gentry	SCS and SRVWU
Grand Canyon	
Happy Jack	
Heber	
Inman	C. H. McCauley
Iron Springs	Ernest Saxby
Maverick Fork	
Milk Ranch	
Mingus Mountain	
Mogollon	
Mormon Lake	
Mormon Mountain	
Munds Park	
McNary	
N-Bar Lake	SCS
Negrito	
Nutrioso	
Pacheta	Foch Phillips
Rose Canyon	Wm. Hughes & J.R. Brinkley
State Line	
Taylor Creek	
Willow Ranch	
Workman Creek	C. L. Moore

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The following organizations cooperate in the Arizona anow survey work:

#### FEDERAL

Department of Agriculture

Forest Service
Apache Forest
Coconino Forest
Coronado Forest
Gila Forest
Kaibab Forest
Prescott Forest
Sitgreaves Forest
Southwestern Forest and Range Experiment
Station, Fort Valley, Arizona
Sierra Ancha Forest Experiment Station

Soil Conservation Service

Department of Commerce Weather Bureau Arizona Section

Department of Interior

Burgau of Reclamation Region III

Geological Survey
Arizona District

Bureau of Indian Affairs Fort Apache Reservation

National Park Service Grand Canyon National Park

Gila Water Commissioner, Safford, Arizona

#### IRRIGATION PROJECTS

Salt River Valley Water Users' Association, Phoenix, Arizona

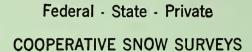
San Carlos Irrigation and Drainage District, Coolidge, Arizona

SOUTHWEST LUMBER MILLS, INC., McNary, Arizona

Other organizations and individuals furnish valuable information for the snow survey reports. Their co-operation is gratefully acknowledged.







Furnishes the basic data necessary for forecasting water supply for irrigation, domestic and municipal water supply, hydro-electric power generation, navigation, mining and industry

"WATER IS THE WEST'S GREATEST RESOURCE"